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The major objective of this program is to prepare a technically qualified data processing technician who can assist a systems analyst in designing a logical systems approach to solve data handling problems, develop detailed data processing procedures, wire control panels or write programs, document these procedures in a professional manner, develop test data, and test the procedures and programs. Description, hours required, and course outlines are given for the following courses: (1) Introduction to Data Processing Principles, (2) Unit Record Processing Equipment, (3) Data Processing Applications 1, 2, and 3, (4) Introduction to Engineering Applications, (5) Basic Computer Systems, (6) Computer Programming 1, 2, 3, 4, and 5, (7) Systems Development and Design 1, 2, and 3, (8) Accounting 1, 2, and 3, (9) Principles of Statistical Analysis 1 and 2, (10) Business Organization, (11) Data Processing Mathematics 1, 2, and 3, (12) Communications Skills 1, 2, and 3, and (13) Social Science 1, 2, and 3 (Industrial Psychology, Supervisory Training, and Industrial Economics). (PS)

STATE OF WASHINGTON

TECHNICAL EDUCATION

DATA PROCESSING

Two-Year Curriculum

1963

STATE BOARD FOR VOCATIONAL EDUCATION

VT00

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State of Washington
STATE BOARD FOR VOCATIONAL EDUCATION
Olympia

DATA PROCESSING

A SUGGESTED TWO-YEAR

POST HIGH SCHOOL CURRICULUM

August, 1963

Second Edition

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MEMORANDUM

TO: The ERIC Clearinghouse on Vocational and Technical Education
The Ohio State University
980 Kinnear Road
Columbus, Ohio 43212

FROM: (Person) Frank H. Wimer, Director (Agency) Trade, Industrial and Technical Education
(Address) Division of Vocational Education
P. O. Box 248 - Olympia, Washington 98501

DATE: August 26, 1968

RE: (Author, Title, Publisher, Date) ~~Data Processing. A~~ Suggested Two-Year Post High School Curriculum. Washington State Board for Vocational Education

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Method of Design, Testing, and Trial industry.
Designed by individuals working in Data Processing and teaching Data Processing in the schools. Tested by school supervisors and instructors and representatives from private industry in a series of seminars conducted during past two years.

(3) Utilization of Material:
Appropriate School Setting Community colleges and vocational-technical schools.
Type of Program Vocational Education
Occupational Focus Occupational Cluster
Geographic Adaptability No geographic limitations
Uses of Material Development of Data Processing programs and methods of
Users of Material Instructors and students in community colleges instruction.
and vocational-technical institutes.

(4) Requirements for Using Material:
Teacher Competency 3 years gainful employment in Data Processing field and
Student Selection Criteria Interest and GATB Testing recommendation of employing authorities
Time Allotment About 50% of full time to Data Processing content and application.

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FOREWORD

Data Processing is one of the fastest growing and most dynamic industries today. The rapidly increasing use of data processing equipment has created an urgent need for personnel trained to effectively utilize this equipment. Many of today's businesses and industries depend on the results provided by data processing systems as a base for their management decisions.

This Data Processing Curriculum Guide presents a balanced program of education in this vital field. The curriculum is designed basically for a day preparatory program providing occupation-centered education designed to train individuals for gainful employment and to provide a source of skilled manpower.

The technical portion of the curriculum is designed to teach the technology of this industry. These courses in basic data processing cover punched card machine procedures, basic computer programming concepts, systems design and machine applications. The major portion of the time is devoted to these courses.

Related courses are included to give scope and background to the student. These courses in accounting principles, communication skills, human relations, business organization and math, provide essential background information for the data processing technician.

This curriculum was developed by the Washington State Board for Vocational Education in cooperation with the International Business Machines Corporation. It has been prepared to assist schools in planning programs in post-high school institutions. The material developed in this manual is based upon the U. S. Office of Education Business Data Processing Curriculum Guide and statewide conferences attended by ten vocational-technical schools and community colleges from the State of Washington.

Local advisory groups should review the curriculum when new programs of training are being considered. Since local requirements vary, factors such as student entrance requirements, instructional staff competencies, local employers needs and coordination with existing programs will influence the design of a program. Recognizing the dynamic nature of data processing technology today, the curriculum herein has sufficient flexibility to allow modifications without disturbing the necessary sequence of instruction.

H. N. Miller, Assistant Superintendent
for Vocational Education

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DATA PROCESSING TECHNOLOGY

INTRODUCTION

This curriculum guide was designed for use in post-high school technical schools and community colleges of the State of Washington which are initiating training programs in Data Processing. Its purpose is not only to guide these schools in developing balanced programs, but also to encourage standardization and to make possible the sharing of experiences, materials, and ideas among the schools, as well as to assure industry of uniformly, highly-trained individuals.

OBJECTIVES OF THE PROGRAM

The major objective of this two-year program is to prepare a technically-qualified data processing technician. Such a person must be knowledgeable of the field of data processing technology, including the environment in which he will be working as well as be technically proficient in machine functions and operations. He should be able to perform the following basic functions associated with a data processing center:

1. Assist a Systems Analyst in problem definition, and in the design of a logical systems approach to solving data handling problems and providing required information to all levels of the organization.

2. Develop detailed data processing procedures, wire control panels or write programs, and document these procedures in a professional manner.

3. Develop test data and test the procedures and programs.

4. Implement the use of the system.

5. Make modifications and changes as they are required.

Graduates should have a general knowledge of the wide range and variety of equipment with proficiency in the use of one particular machine. They should be capable of learning the programming of any specific machine with a minimum of additional training. They will have the opportunity to advance to positions of greater responsibility in industry.

In addition to the major objective of Computer Programmer, the curriculum has two other minor objectives.

1. At the end of the first year, a student should be qualified as a Programmer trainee or Unit Record Operator.

2. Additional courses may be offered as exploratory or general education for the student who needs an appreciation of Data Processing as a tool for their occupational or professional objective.

Examples of such courses might be:

a. An orientation class offered through the adult evening program to the general public who desire a general knowledge of the field of Data Processing.

b. An introduction to Data Processing for business or industrial managers to aid them in making better use of Data Processing in their daily activities.

c. Upgrading courses for persons presently engaged in Data Processing occupations.

d. Orientation and programming courses for the college student preparing for other vocations or professions which use Data Processing.

e. An introductory course for high school students.

SUGGESTED STUDENT PREPARATION

It is desirable that students entering the program have demonstrated competence in high school mathematics, especially algebra. In addition, they should have shown an interest in mathematical analysis and physical sciences. The latter may actually be more significant, for the students' progress in this field, than credit in advanced mathematics courses. Aptitude tests, interviews and limitations on class size will determine acceptance into the program.

Experience with student success in this program indicates that those who pass the "Programmers' Aptitude Test" with a minimum score of 50 have a realistic opportunity for success in the program and on the job. This score should be used as a valid indicator of the applicant's chances for success, but other factors, such as personality, energies, goals, and past achievement, which will effect the student's potential, should be considered.

INSTRUCTOR QUALIFICATION

Essential to the success of any curriculum is a well-qualified instructional staff. These qualifications include technical competence, business experience, and professional education. Instructional personnel in this program must have experience in the practical problems of data processing. Professional training in educational processes and teaching methods should be required of all teachers.

Instructors should have a minimum of three years of data processing experience beyond the learning period, working with a variety of equipment in varied situations in business or industry. He should have performed competently at the level of advanced programmer, systems analyst, and supervisor of a Data Processing department using a computer system.

THE CURRICULUM

There are two factors to be considered in the designing of any technical education curriculum. One is to provide the training which is essential to employment. The other is to provide education that develops an informed, responsible, participating citizen. The problem is to determine a proper balance between them. If each is to be achieved in considerable measure, neither can be realized in its entirety. We feel that a proper balance has been achieved in technician training when the student spends 50% of his time in his technical speciality (Data Processing lab), 30% of his time in the basic background subjects (math, accounting, English) and the remaining 20% of his time in general education and electives. These courses are designed specifically to meet the needs of the technician and are not the traditional academic courses. The subject matter is related to data processing, throughout each of the courses.

Although the emphasis throughout the curriculum is on data processing technology primarily concerned with the business community, it will also prepare the student for the scientific and industrial control areas. Some schools take the basic approach that there are three occupational objectives in Data Processing: Business Data Processing, Scientific Data Processing, and Industrial Process Control. A school decides which objectives its training program will meet, orders equipment, and obtains an instructional staff to effect its stated objectives. The suggested curriculum in this booklet takes a somewhat different approach; that technical training programs should be offered on a broader basis, or on a core or family approach, dealing with more of the basic principles of the technology. Industry will offer the specialized training peculiar to their type of work. Systems Programming for business, scientific, and process control, all three have a common body of knowledge and if a programmer is trained with sufficient depth he will understand the basic principles of programming to a point where he will be able to acquire the knowledge of a particular machine or problem during a brief company training course. Specific technical application areas may require mathematics or other technical courses in addition to the core subjects presented in this curriculum.

This Data Processing Curriculum is based upon the three-hour block of time approach, meaning that a student would spend three hours per day in the data processing laboratory/classroom and two or three hours on related subjects. The major reasons for this approach are:

1. It allows the technology to be tailored to the student's needs, allowing more individual contact.

2. It allows more flexibility than the one-hour program, because the instructor can move from lecture, to demonstration, to students' practice, in varying the time according to the manner best suited to the topic of discussion.

3. This approach allows effective use of the laboratory. For example, one group of students could use the lab in the morning and take the related training in the afternoon while another group could reverse this schedule.

4. The technical instructor's time can better be utilized teaching the three-hour data processing class which he knows best. Other specialized instructors of the vocational education staff would teach the specialized math and accounting, etc.

5. It allows more flexibility by rotating students on different machines giving them time for different projects in the laboratory.

6. It allows for an ideal amount of student-instructor contact so the technical instructor can work individually with the students in the three-hour block of time while the student will also have the advantage of coming in contact with two or three other related instructors.

7. It allows time for immediate response by actually performing in the laboratory, operations and techniques introduced by the instructor in lecture.

8. The State Plan for operating Vocational-Technical Education Programs based upon State and Federal regulations set forth the minimum of three hours per day on the occupational objective.

THE TECHNOLOGY

Instruction in the field of specialization starts in the first quarter with three courses devoted to the principles of operation, capacities and limitations of some of the less complex data processing equipment including control panel wiring, programming of collators, reproducers, accounting machines, and calculating punches. Data processing applications are introduced in the second quarter along with an introduction to programming.

There are five courses in programming computers, two courses in systems, and a field study or work experience project in systems. The programming courses deal with the elements of automatic coding, the planning and programming of computer applications in accounting, auditing and data protection and programming electronic digital computers. The courses in systems and procedures for data processing includes a study of integrated or total management information systems with emphasis on work simplification and procedure writing. This is reinforced by field work involving feasibility studies in actual business situations.

RELATED COURSES

Included in the curriculum, in addition to the courses in data processing technology, are courses in related areas and subjects. The courses will give the student the necessary appreciation and understanding of Data Processing users' problems and desires, so that he may use his technical knowledge effectively.

The handling of business records and the control of accounts, inventory, sales, income and expenditures are essential basis for management decisions. To provide an adequate understanding of the principles of accounting, three courses are included in the curriculum. (Accounting is closely allied with data processing techniques during the first year.)

Mathematics courses cover basic logic, the number systems, algebra with emphasis on problem solving, computations with logarithms, and Boolean algebra.

A course in elementary statistics covering descriptive statistics and statistical inference is included to give background for data processing and the elements of business systems analysis.

Exceedingly important as a part of Data Processing training is the development of proficiency in communication skills. It is necessary to communicate data and ideas clearly and effectively. Courses in communication are included in the curriculum in the first year. Such courses give special attention to the development of the ability to write clearly and concisely. Report writing and methods of presentation of data to management should be included. Provision is also made to develop skill in oral communication.

The curriculum outlined herein has had intensive review by representatives of business, industry, and educators concerned with this field of work. It is the product of the pooled suggestions of a large number of people and represents somewhat the middle ground of the recommendations which have been received.

This curriculum guide indicates the scope, or breadth, of the concepts to be introduced and a suggested sequence into which these concepts can be arranged. It contains outlines of the courses to be presented.

The job of preparing course instructional materials, teaching guides, units of instruction, and making the curriculum fit local needs and conditions is the job of the instructional staff of the school utilizing the curriculum. In short, the individual laboratory or classroom teacher with competent and expert advice, will make the final determination of the actual units of instruction, the time to be spent on each topic, which textbooks and references to use, and what supplementary materials will be necessary to develop the best learning situation.

The curriculum can only suggest those areas of information which should be covered to give students a fund of knowledge and a level of competency which will enable them to enter and make progress in business and industry. The instructor must determine the proper application of the concepts outlined in this curriculum. The school should seek the assistance of a local advisory committee consisting of: representatives of labor, industry, and professional associations; local school supervisors and administrators; and technical consultants; all of whom can help in developing courses of study for the curriculum and in determining local adaptations.

In summary, this curriculum is the product of the efforts of a large number of people--educators, Data Processing specialists, representatives from business, government, industry, and Office of Education staff. It is a suggested outline of learning experience considered as a necessary part of the training of Data Processing personnel. It has been prepared for use as a guide in developing a curriculum which will reflect prevalent ideas and opinions of State and local people, and one which will meet the national needs for occupations in this field of work.

DATA PROCESSING
TWO YEAR POST HIGH SCHOOL CURRICULUM

First Year

First Quarter (Fall)

Time	Subject	Hours	Credits	Hrs. per wk. Class Room	Hrs. per wk. DP Lab	Outline Page
8:00	Data Processing Laboratory I	180	8		15	
to	Introduction to Data Processing Principles	(30)				6-7
11:00	Unit Record Processing Equipment	(150)				8-11
11:00	Communication Skills I	36	3	3		60-62
12:00	Lunch					
1:00	Data Processing Mathematics I	36	3	3		55
2:00	Principles of Accounting I	36	3	3		44-45

Second Quarter (Winter)

8:00	Data Processing Laboratory II	180	8		15	
to	Unit Record Processing Equipment	(40)				8-11
11:00	Data Processing Applications I	(40)				12-15
	Basic Computer Systems	(40)				21-22
	Computer Programming I	(60)				23-25
11:00	Communication Skills II	36	3	3		63-64
12:00	Lunch					
1:00	Data Processing Mathematics II	36	3	3		56
2:00	Principles of Accounting II	36	3	3		46-47

Third Quarter (Spring)

8:00	Data Processing Laboratory III	180	8		15	
to	Computer Programming II	(140)				26-27
11:00	Data Processing Applications II	(40)				12-15
11:00	Communication Skills III	36	3	3		65-66
12:00	Lunch					
1:00	Principles of Statistical Analysis I	36	3	3		50-51
2:00	Principles of Accounting III	36	3	3		48-49

Second Year

Fourth Quarter (Fall)

Time	Subject	Clock Hours	Credits	Hrs. per wk. Class Room	Hrs. per wk. DP Lab	Outline Page
9:00	Principles of Statistical Analysis II	36	3	3		52
10:00	Social Science (Industrial Psychology)	36	3	3		67-69
11:00	Elective	36	3	3		56
12:00	Lunch					
1:00 to 4:00	Data Processing Laboratory IV	180	8		15	
	Computer Programming III	(140)				28-31
	Systems Development and Design I	(40)	8			39

Fifth Quarter (Winter)

9:00	Data Processing Mathematics III	36	3	3		57
10:00	Business Organization and Management	24	2	2		53
11:00	Social Science II (Supervisory Training)	36	3	3		70
12:00	Lunch					
1:00 to 4:00	Data Processing Laboratory V	180	8		15	
	Computer Programming IV	(90)				32
	Data Processing Applications III	(30)				16
	Systems Development and Design II	(60)				42

Sixth Quarter (Spring)

9:00	Introduction to Engineering Applications	36	3	3		19
10:00	Elective	36	3	3		
11:00	Social Science III (Industrial Economics)	36	3	3		72
12:00	Lunch					
1:00 to 4:00	Data Processing Laboratory VI	180	8		15	
	Computer Programming V	(120)				35
	Systems Development and Design III	(60)				

INTRODUCTION TO DATA PROCESSING PRINCIPLES

HOURS REQUIRED: 30

DESCRIPTION

All data processing is the result of a need for information. This course is designed to show the evolution of data processing as the need for information and communication increased with the growth in commerce, business and scientific investigation. It also describes and defines data processing as it exists today, including introduction to unit record principles and machine functions required in modern data processing.

This is primarily a lecture course using desk assignments and practice problems as a means of applying principles learned.

MAJOR DIVISIONS		HOURS
I.	Evolution of data processing	2
II.	Definition of data processing	1
III.	Functions of data processing	4
IV.	The unit record	5
V.	Machine approaches to data processing	18

DIVISION I - EVOLUTION TO DATA PROCESSING

A. History
B. Development as related to need
C. Beginnings of punched card data processing
D. Need for data processing today
E. Future of data processing

DIVISION II - DEFINITION OF DATA PROCESSING

A. Film - "The Information Machine"
B. Need for information
C. Sources of data
D. Processing to provide desired information

DIVISION III - FUNCTIONS OF DATA PROCESSING

A. Recording
B. Classifying and arranging
C. Calculating
D. Summarizing
E. Communicating (Report Preparation)
F. Controlling (balancing)

DIVISION IV - THE UNIT RECORD

A. Card as a "unit" of data
B. Card format
    1. Size of card

2. Coding in one column
3. 80 columns
4. Card fields
5. Control punches (Identification)

C. "The Magic Window" - slides
D. Flexibility in processing
1. Value of the unit record
2. Elimination of manual operations
3. Accuracy and control
4. Availability of information

DIVISION V - MACHINE APPROACHES TO DATA PROCESSING

A. Description of basic machine functions (relate machines to sub-topics in Division III)
B. Operation of basic machines (lab project)
C. Field trip to unit record installation
D. Field trip to computer installation

FILMS AND SLIDES

Information Machine - IBM
The Magic Window - IBM

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500-0002 New Methods for Knowing
C20-8078 Form and Card Design
F20-0074 Introduction to Punched Card Accounting
R25-1605 BMOW Education Guide
IBM Machine Operation & Wiring, Salmon, Lawrence J., Wadsworth Publishing Co., California
See education guides for additional references

UNIT RECORD PROCESSING EQUIPMENT

HOURS REQUIRED: 190

DESCRIPTION

This course is a survey of unit record equipment. It illustrates the need for machine-processable solutions to accounting and record keeping problems. The concept, power and flexibility of the unit record approach are imparted to the student during these sessions.

Unit record equipment as an independent Data Processing system is discussed and studied throughout the course. In addition to this emphasis, its use with and support for computers should be included.

Laboratory exercises are executed, which involve planning and wiring a range of unit record equipment. Practical exercises, typical of those performed in existing machine installations, are offered.

MAJOR DIVISIONS		HOURS
I.	Introduction to unit record systems	2
II.	Unit record machine functions and elements	5
III.	The card punch and verifier	5
IV.	Interpreters	4
V.	Sorters	4
VI.	Accounting Machines - Printers	95
VII.	Reproducing punches	15
VIII.	Collators	20
IX.	Calculating punches	15
X.	Other machines	5
XI.	Unit record equipment in support of a computer system	15
XII.	Field Trips	5

DIVISION I - INTRODUCTION TO UNIT RECORD SYSTEMS

A. Review development of unit record systems
B. Relate data processing functions to available machines
C. Demonstrate basic data processing functions on unit record machines
D. Discuss organization of machine room, safety, care and cleaning of equipment

DIVISION II - UNIT RECORD MACHINE FUNCTIONS AND ELEMENTS

A. Recording
B. Classifying
C. Calculating
D. Report printing
E. Auxiliary operations
F. General operating features
G. Card feed

H. Card reading
I. Control panels - Entries and Exits
J. Printing units
K. Punching units

DIVISION III - THE CARD PUNCH AND VERIFIER

A. Functions and features
B. Alphabetic and numeric punching
C. Duplicating
D. Program drum and the control card
E. Printing (026)
F. Verification

DIVISION IV - INTERPRETERS

A. Functions and operating features
B. Interpreting
C. Interpreting with selection
D. Zero control
E. Special features

DIVISION V - SORTERS

A. Functions, operating features, types
B. Principles of numeric sorting
C. Principles of alphabetic sorting
D. Sort suppression and card counting
E. Card or group selection using the sorter
F. Block sorting
G. Statistical machines (brief review)

DIVISION VI - ACCOUNTING MACHINES - PRINTERS

A. Functions, operating features, types
B. Report printing and format control
    1. Detail printing (listing)
    2. Group printing with program control
    3. Zero print control
C. Counter control - addition and total printing
D. Program control - normal and special programming
E. Selection
    1. Digit selectors
    2. Pilot selectors
    3. Co-selectors
    4. Special selectors - (print entries - progressive selector)
F. Counter control - subtraction and negative balance control
G. Emitters, storage, filters
H. Special character printing
I. Carriage control
    1. Spacing
    2. Overflow

3. Skipping
4. Heading - detail controls

J. Summary punching
K. Multiple line printing
L. Timing chart
M. Special features

DIVISION VII - REPRODUCING PUNCHES

A. Functions and operating features
B. Reproducing - comparing
C. Field selected reproducing - comparing
D. Gang punching - gang punch comparing
E. Mark sensing
F. End printing
G. Summary punching

DIVISION VIII - COLLATORS

A. Functions, operating features, types
B. Basic theory of the machine operation
C. Sequence checking
D. Merging
E. Matching
F. Selection
G. Special applications of the collator

DIVISION IX - CALCULATING PUNCHES

A. Functions, operating features, types
B. Crossfooting - punching results
C. Negative balance control
D. Multiplication
E. Division
F. Planning the operation
G. Multiple card operations
H. Additional references

DIVISION X - OTHER MACHINES

A. Data transmission
B. Data collection
C. Paper tape equipment
D. High speed editing (101,108)

DIVISION XI - UNIT RECORD EQUIPMENT IN SUPPORT OF A COMPUTER SYSTEM

A. Type of support required - functions and equipment
B. Preparation and verification of input data
    1. Punch and verify
    2. Sort, collate and edit

3. Pre-balancing and establishing control
4. Program preparation

C. Data output (cards)
1. Balancing
2. Filing

D. Data output (printed)
1. Supplementary reports
2. Balancing
3. Control ledgers
4. Distributions

DIVISION XII - FIELD TRIPS

A. To be developed
B. As time permits

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R25-1605 BMOW Education Guide
R25-9541 24-26 Card Punch Education Guide
224-6024 Principles of Operation Bulletin (set)
R25-1601 85 Collator Education Guide
R25-1020 407 Education Guide
R25-0753 402/3 Customer Training Outline
A24-1027 357 Reference Manual
A24-0510 108 Reference Manual
A24-0502 101 Reference Manual
A24-0512 65-66 Data Transceiver
A24-1029 1001 Reference Manual
224-6064 46-47 Tape-to-Card Punch
224-5997 63 Card Control Tape Punch
A24-1005 85-87 Collator Ref. Man.
A24-1017 519 Doc. Orig. Mech. Ref. Manual
A24-1011 407 Acctg. Mach. Ref. Manual
224-6384 548-552 Interpreter Ref. Manual

See education guides for additional references

DATA PROCESSING APPLICATIONS I AND II

HOURS REQUIRED: 80

DESCRIPTION

A knowledge of comm n data processing applications is essential in order to understand the problems and techniques of using modern data processing machines. This course is designed to acquaint the student with the basic concepts, objectives and general approaches to actual data processing applications. He gains an understanding of how machine systems and personnel functions are combined, and the advantages to be realized from mechanization.

The course includes lectures, demonstrations and student case studies to assist him in learning to apply the principles of data processing and the functions of the machine to various applications.

MAJOR DIVISIONS	HOURS
I. Procedure Development and Documentation	5
II. Order Writing and Billing	10
III. Inventory Control	20
IV. Accounts Receivable	10
V. Accounts Payable	10
VI. Payroll and Labor Distribution	20
VII. General Ledger	5

DIVISION I - PROCEDURE DEVELOPMENT AND DOCUMENTATION

A. Procedure Development
   1. Define objectives
   2. Determine requirements
   3. Determine source data
   4. Flow chart the procedure
B. Documentation
   1. For management
   2. For data processing personnel
   3. For staff (other than data processing)

DIVISION II - ORDER WRITING AND BILLING

A. Theory and concepts of order writing and billing
   1. Objectives
   2. Relationship to distributive family of applications
   3. Variations in source information
   4. Types and variations in invoicing and associated reports
   5. Controls on processing
B. Basic Approaches to a Common Billing Application
   1. Unit record example
   2. Ramac - computer example
   3. Possibilities of real time, in line inputs

C. Sales Analysis
    1. By item, salesman, location, area, period of time
    2. Reports to affected individuals
    3. Effect on other functions of business
D. Summary
    1. Advantages of mechanized billing
    2. Resultant advantages from entries to other applications
    3. Advantages of random access file on computer
E. Case studies

DIVISION III - INVENTORY CONTROL

A. Theory and concepts of the inventory control function
    1. Inventory control vs material accounting
    2. Typical business inventories
    3. Management objectives of inventory control
B. The basic inventory formula
    1. Factors involved
    2. Modifications depending upon requirements of the business
    3. "Minimum" and "reorder point" systems
C. Establishing controls
    1. Coding methods
    2. Accuracy
        a. Machine controls
        b. Accounting controls
D. Procedural approaches
    1. The balance forward plan
    2. The unit tub file plan
E. Physical inventory
F. Inventory control systems using electro-mechanical machines
G. Inventory control systems using basic computing machines
H. Case studies

DIVISION IV - ACCOUNTS RECEIVABLE

A. Theory and concepts of the accounts receivable application
    1. Objectives and importance of accounts receivable
    2. Relationship of receivables to the distribution family
    3. Making entries
    4. Controls
B. Basic approaches to accounts receivable
    1. Open item approach
        a. Cash payments
        b. Trial balance statements
    2. Balance forward approach
        a. Cash payments and trial balance statements
C. A/R Systems using electro-mechanical data processing machines
D. A/R Systems using basic computing machines
E. Summary
    1. Comparison of open item and balance forward approaches
    2. Advantages of mechanized accounts receivable methods
F. Case studies

DIVISION V - ACCOUNTS PAYABLE

A. Theory and concepts of the accounts payable application
    1. Functions of the accounts payable department
    2. Affect on general ledger
B. Establishing liability
    1. Purchase requisition
    2. Purchasing department functions
    3. Purchase order preparation
C. Validating liability
    1. Internal expenses
    2. Outside charges
    3. Receiving reports
    4. Debit memos
D. Posting liabilities
    1. Ledgers
    2. Discounts
        a. Trade
        b. Cash
        c. Anticipation
E. Writing checks
F. Applying distributions
    1. Allocating expenses
    2. Analyzing records
G. Accounting controls
H. Accounts payable system using electro-mechanical machines
I. Accounts payable system using basic computing machines
J. Advantages of mechanized accounts payable methods
K. Case study

DIVISION VI - PAYROLL AND LABOR DISTRIBUTION

A. Theory and concepts of the payroll application
    1. Interrelationship to other application areas
    2. Effect on the balance sheet
    3. Effect on the income statement
B. Payroll source data
    1. Attendance documents
    2. Production documents
        a. Job cards
        b. Time sheets
        c. Daily time tickets
    3. Tax and miscellaneous deduction documents
    4. Computative data
    5. Classification data
    6. Identification data
C. Controls
D. Types of payroll
    1. Hourly
    2. Salary
    3. Incentive

E. Overtime
    1. Reporting
    2. Computing
    3. Variations
F. Gross-to-Net
    1. Tax computation
        a. Federal income taxes
        b. FICA
        c. State income taxes
        d. Tax proof
    2. Deduction computation
        a. Fixed
        b. One-time
G. Payroll register
H. Checks and earning statements
I. Check reconciliation
J. Tax reports
K. Payroll cost analysis and distribution
    1. For accounting purposes
    2. For management control
    3. For cost analysis
L. Procedure study requirements
    1. Volume considerations
    2. Reports
    3. Schedule requirements
    4. Payroll computations
    5. Management requirements
M. Mechanized approaches
    1. Payroll systems using electro-mechanical data processing machine
    2. Payroll systems using basic computing machines
N. Summary
    1. Procedural advantages of a mechanized payroll
    2. Advantages to management of a mechanized payroll
O. Case studies

DIVISION VII - GENERAL LEDGER

A. Chart of accounts
B. Source records
C. Trial balance
D. Income statement
E. Balance sheet
F. The general ledger

BIBLIOGRAPHY

R23-9690 Field Applications Instruction Outline
C20-8008 Flow Charting and Block Diagramming
C20-8060 Documentation and Accounting Controls
C20-8075 SOP - Documentation
Systems & Procedures for Automated Acctg., Randle, Weimer, Greenfield, South-Western Publishing Co., Calif.
Automatic Data-Processing Systems, Gregory & Van Horn, Wadsworth Publishing Co., California

See field applications instruction outline for additional references.

DATA PROCESSING APPLICATIONS III

HOURS REQUIRED: 30

DESCRIPTION

The type of data processing required by business varies with the type of industry. This course is designed to orient the student to the variation in data processing in several different industries. Through discussion, lecture and field trips the student is assisted in recognizing the applications and uses of data processing in selected industries. Industries included are intended as examples and were selected because of availability of materials.

MAJOR DIVISIONS

I. Distribution industry - wholesale
II. Food distribution
III. Transportation
IV. Manufacturing control
V. Lumber and Plywood
VI. Government - state, local and education

DIVISION I - DISTRIBUTION INDUSTRY - WHOLESALE
Reference: K20-0984 Application Manual, Bigelow and Dowse Company

A. Order writing
B. Invoicing
C. Sales analysis
D. Commission accounting
E. Accounts receivable
F. Inventory control
G. Back order control
H. Purchase order writing
I. Stock status ledgers

DIVISION II - FOOD DISTRIBUTION
Reference: E20-0019 Application Manual, Retail Billing and Route Accounting for the Dairy Industry

A. Driver loading and balancing
B. Billing - wholesale and retail
C. Vendor payments
D. Route accounting
E. Inventory control
F. Accounting applications

DIVISION III - TRANSPORTATION
Reference: K20-0998 Application Manual, Fox and Ginn, Motor Freight Accounting
E20-0044 Application Manual, Motor Freight Accounting

A. Billing
B. Accounts receivable
C. Sales analysis
D. Maintenance records
E. Accounting applications
F. Revenue accounting

DIVISION IV - MANUFACTURING CONTROL

Reference: K20-0920 Application Manual, Norma-Hoffman Bearings Corp.
E20-6028 Application Mannual, 705 Manufacturing Control

A. Introduction
B. The production schedule as the basis for manufacturing control operations
C. Estimating machine features necessary to satisfy production schedule
D. Field and interplant requirements
E. Updating engineering specifications
F. The requirements explosion
G. Inventory control
H. Daily inventory transactions and ordering
I. Order implementation
J. Internal stores, shipping and traffic
K. Special reports

DIVISION V - LUMBER AND PLYWOOD

A. Inventory control
B. Sales analysis
C. Order writing and billing
D. Accounts receivable
E. Production forecasting and control

DIVISION VI - GOVERNMENT

A. State
   1. Appropriation accounting and control
   2. Tax and revenue accounting
   3. Retirement fund accounting
   4. Public assistance payments
   5. Driver licensing and control
   6. Vehicle licensing and control
   7. Statistical applications
   8. Employment security and placement services
   9. Highway engineering

B. Local - county and municipal
   1. Appropriation accounting and control
   2. Tax rolls, billing and records
   3. Voter registration
   4. Library control

C. Education
   1. Public school student scheduling and records
   2. Budgetary control
   3. Inventory control
   4. Plant and equipment
   5. Personnel accounting
   6. Statistical records

References: E20-8048 Appropriation Accounting and Budgetary Control
E20-0056 Public Education, Student Records
K20-0097 City of Bethlehem, Pennsylvania Municipal Accounting

E20-0072	Circulation Control at Brooklyn College Library
E20-0089	St. Louis Metropolitan Police Department Accounting
E20-8051	Driver Licensing and Control
E20-0261	Real Property Accounting
E20-0267	Welfare Payments
E20-2028	State and Local Government Accounting

INTRODUCTION TO ENGINEERING APPLICATIONS

HOURS REQUIRED: 36

DESCRIPTION

The student will be introduced to the basic engineering and scientific computing applications. He will learn to use FORTRAN, a programming system designed to simplify the translation of mathematical formulas into a computer program, through lecture and laboratory practice.

This is a survey course for the general information of the student.

MAJOR DIVISIONS		HOURS
I.	Fortran	14
II.	Programming mathematical problems	5
III.	Principles of iteration	5
IV.	Mathematical models and selected topics	5
V.	Operations research	7

DIVISION I - FORTRAN

A. Need for Fortran
B. Definition of Fortran terms
C. Fortran statement format
D. Arithmetic statements
E. Floating and fixed point notation
F. Floating and fixed point expressions
G. Input, output statements
H. Logical statements
I. Functions
J. Practice problems

DIVISION II - PROGRAMMING MATHEMATICAL PROBLEMS

A. Block diagramming
B. Subscripting
C. Consideration of errors in the problem
D. Recursion formulas
E. Algorithms
F. Complex number calculations
G. Transformations and identities

DIVISION III - PRINCIPALS OF ITERATION

A. Arithmetic, mathematics and the computer
B. Numerical analysis
C. Algebraic equation
D. Iteration type problems

DIVISION IV - MATHEMATICAL MODELS AND SELECTED TOPICS

A. Heat transfer problem
B. Spring problem
C. Automobile suspension
D. Vehicle simulation model
E. Matrix inversion
F. Elgen value problem
G. Temperature-distribution problem

DIVISION V - OPERATIONS RESEARCH

A. Job shop simulation
B. Inventory control
C. Linear programming
D. Critical path scheduling

BIBLIOGRAPHY

F20-8077 An Introduction to Engineering Applications, IBM
R20-4000 Introduction to Scientific Computing Techniques and Procedures
F28-8074 Fortran General Information
C26-5602 1620 Fortran II Specifications
C26-5619 1620 Fortran
J26-5662 1620 Fortran II Operator's Guide
C26-5594 1620 Gotran
R27-9586 1620 Education Guide

BASIC COMPUTER SYSTEMS

HOURS REQUIRED: 40

DESCRIPTION

All data processing systems, regardless of size, type, or basic use, have certain common fundamental concepts and operational principles. This course is not an introduction to any specific machine; but, rather, is intended to provide a foundation for future detailed study of specific systems.

Lectures include an introduction to problem organization, coverage of basic types of storage media, fundamentals of input and output operations, and elementary programming techniques.

MAJOR DIVISIONS	HOURS
I. Types of computer applications	3
II. Definition of a computer system	4
III. Relative merits - various types of computers	4
IV. Characteristics of computers	8
V. Defining a problem (block diagramming)	15
VI. Operating the computer (1620)	6

DIVISION I - TYPES OF COMPUTER APPLICATIONS

A. Application areas
    1. Commercial
    2. Scientific
    3. Process control
    4. Numerical control
    5. Planning and simulation
B. Scope of computer types
    1. Decimal - large and small systems
    2. Binary - large and small systems
    3. Special purpose computers

DIVISION II - DEFINITION OF A SYSTEM

A. Elements of a system
B. Interaction of the elements; makeup and operation of the system
C. External environment; its effect and demands on the system

DIVISION III - DATA PROCESSING SYSTEMS, RELATIVE MERITS OF VARIOUS TYPES

A. Manual systems
B. Key driven equipment systems
C. Punched card systems
D. Computer systems
E. Ideal system - real time, complete, accurate and instantaneous communication to all concerned.

DIVISION IV - CHARACTERISTICS OF COMPUTERS

A. External environment
    1. Definition of the problem
    2. Requirements of the system
    3. Handling of source data
    4. Distribution of information
B. Elements of the system
    1. Input-output media
    2. Storage - internal and external
    3. Internal processing - arithmetic and data flow
    4. Computer characteristics
C. Interaction of the elements
    1. Control unit
    2. Programming and instruction analysis
    3. Control of accuracy
    4. Communication between computer and operator
    5. Testing program
    6. Testing system

DIVISION V - DEFINING A PROBLEM

A. Collecting factual data
B. Organizing the facts
C. Block diagramming

DIVISION VI - OPERATING A COMPUTER

A. Demonstration
B. Student practice exercises

FILMS

Film strip - Principles of EDP Systems

BIBLIOGRAPHY

R25-1552 BCS Educational Guide
F20-6088 Planning for an IBM Data Processing System
C20-8008 Flow Charting and Block Diagramming
D24-1473 1428 Alphameric Optical Reader
G22-6510 Magnetic Tape Units
Accounting Systems and Data Processing, Chapter 21, Nelson and Woods, South-Western Publishing Company
Introduction to Electronic Data Processing Equipment, Oakford, McGraw-Hill
Computer Programming Fundamentals, Leeds & Weinberg, McGraw-Hill
Programming Computers for Business Applications, Chapin, McGraw-Hill
The Language of Computers, Galler, McGraw-Hill

See educational guide for additional references.

COMPUTER PROGRAMMING I

HOURS REQUIRED: 60

DESCRIPTION

The Basic Computing Systems course provided the concepts and, therefore, the foundation for the upcoming detail study of data processing machines. In this computer programming course, the student engages in discussions of functions and capabilities of the IBM 1620 Data Processing System and a study of basic programming. He performs programming drills, exercises, and case studies which serve to bridge the gap from the academic to the real world of data processing. Laboratory sessions further reinforce basic principles by providing "hands-on" training.

MAJOR DIVISIONS		HOURS
I.	Introduction to the 1620 Data Processing System	1
II.	Data representation within storage	5
III.	Instructions to the machine	24
IV.	Data flow	6
V.	Programming practice	24

DIVISION I - INTRODUCTION TO THE 1620 DATA PROCESSING SYSTEM

A. Physical and functional components
    1. Input-output
    2. Console
    3. Processing unit
    4. Storage
    5. Data representation
    6. Machine operations
    7. Environmental and power requirements
B. Accuracy and reliability
    1. Input hole count
    2. Parity checking
    3. Programmed checks and controls
    4. Checking of programs
    5. Detection and correcting errors
C. Programming systems and packaged programming
    1. Symbolic programming systems
    2. Fortran and gotran
    3. Packaged programs
    4. Monitor program (disk system)

DIVISION II - DATA REPRESENTATION WITHIN STORAGE

A. Storage arrangement
    1. Row of characters - 20000
    2. Addressing
    3. Wrap around

B. Reserved areas
    1. Work areas
    2. Table areas
    3. Input-output areas
    4. Program area
    5. Data areas
    6. A field, a record, an instruction
C. Use of Flags
    1. Fields of data
    2. Instruction
    3. Sign
    4. Indirect addressing - introduce
D. Program writing and testing

DIVISION III - INSTRUCTIONS TO THE MACHINE

A. Instruction format
    1. OP code
    2. P-part and Q-part
    3. Digit instructions
    4. Immediate instructions
B. Input-output operation
    1. Insert operation
    2. Read numerically (36 xxxxx ooxoo)
    3. Write numerically (38 xxxxx ooxoo)
    4. Read alphamerically (37 xxxxx ooxoo)
    5. Write alphamerically (39 xxxxx oxxoo)
    6. Types of I/O
        a. Typewriter (00100)
        b. Paper tape (00200, 00300)
        c. Card (00400, 00500)
    7. Dump numerically (35 xxxxx ooxoo)
    8. Check indicators
C. Data movement instructions
    1. Field definition (flag) - set flag, clear flag
    2. Transmit field
    3. Transmit field immediate
    4. Transmit digit
    5. Transmit digit immediate
    6. Transmit record
D. Console exercise
    1. Identification of keys, indicators, registers
    2. Insert operation
    3. Loading and execution of a simple program
    4. Use of save key
    5. Manual stepping of program using sie key
    6. Manual stepping of program using sce key
    7. Clear storage
E. Logic instructions
    1. Halts
    2. Use of branching
    3. Unconditional branch
    4. Conditional branch
    5. Branch back (using save key)

F. Arithmetic Instructions
    1. Sign control
    2. Add - add immediate
    3. Subtract - subtract immediate
    4. Compare - compare immediate

DIVISION IV - DATA FLOW

A. MBR odd-even
B. MDR
C. Digit register
D. Operation register
E. MARS registers
F. MAR register
G. Increment address registers
H. Other miscellaneous registers
I. Input-output
J. Parity checking

DIVISION V - PROGRAMMING PRACTICE - ABSOLUTE

A. Practice problems
B. Case study
C. Documentation of programs

FILMS

Film strip - IBM 1620 Data Processing System

BIBLIOGRAPHY

Programming the IBM 1620, Germain, Prentice-Hall
Basic Programming Concepts and the IBM 1620, Leeson and Dimitry, Holt, Rinehart, Winston
A26-5604 1620 Reference Summary
C26-5600 1620/1710 Symbolic Programming System
A26-5706 1620 Central Processing Unit
A26-5707 1620 Input/output Units
A26-5708 1620 Special Features
R27-9586 1620 Education Guide
Computers and How they Work, Laurie, South-Western Publishing Co., Calif.
See education guide for additional references

COMPUTER PROGRAMMING II

HOURS REQUIRED: 140

DESCRIPTION

This is a continuation of the programming principles course. The major emphasis during this course is development of the techniques of programming through lecture and laboratory practice projects. Use of symbolic programming will be introduced. Student should become proficient in programming of card system problems.

MAJOR DIVISIONS		HOURS
I.	Introduction to symbolic programming	35
II.	Additional instructions	15
III.	Programming techniques	40
IV.	1620 monitor - Introduction only	
V.	Program testing and modification	15
VI.	Timing program runs	15
VII.	Documentation of programs	20

DIVISION I - INTRODUCTION TO SYMBOLIC PROGRAMMING

A. Development and function of symbolic programming
B. Assembly operation
C. Coding the source program
D. Control statements and comments
E. Declarative statements
F. Imperative statements
G. Unique mnemonics
H. Address arithmetic
I. Labels
J. Subroutines
K. Practice problems using SPS

DIVISION II - ADDITIONAL INSTRUCTIONS

A. Multiply - multiply immediate
B. Divide - divide immediate
C. Numeric strip - numeric fill
D. Move flag
E. Control (K)
F. Subroutine linkage (branch and transmit, branch back)
G. Practice exercises

DIVISION III - PROGRAMMING TECHNIQUES

A. Looping and address modification
    1. Programming loops
    2. Programming loops with data modification
    3. Address modification
    4. Indirect addressing
    5. Programming loops with address modification
B. Subroutines
    1. Open subroutines
    2. Closed subroutines

3. Save key and branch back
4. Branch and transmit

C. Macro instructions
1. Definition and function
2. Available macros in 1620 SPS
3. Writing and adding additional macro instructions

D. Practice projects

DIVISION IV - 1620 MONITOR

A. Operation
B. Disk storage requirements
1. Working storage
2. Tables
3. Label sector

C. Supervisor program
1. Monitor control
2. I/O routines

D. SPS II - D
E. Fortran II - D

DIVISION V - PROGRAM TESTING AND MODIFICATION

A. Error detection during assembly process
B. Desk checking - use of trace and core dumps
C. Preparing test data
D. Analysis of errors
E. Error correction

DIVISION VI - TIMING PROGRAM RUNS

A. Gross timing
1. Timing input-output
2. Estimating process time

B. Throughout timing
C. Practice problem timing

DIVISION VII - DOCUMENTATION OF PROGRAMS

A. Description of the problem
B. Examples of input and output (card and report layouts)
C. Operating procedure and program halt index
D. Schedules
E. Run timing estimates
F. Procedural flow charts
G. Program block diagrams
H. Program listings

Basic Computer Systems Courses,
See Computer Programming I/and 1620 Education Guide for references

COMPUTER PROGRAMMING III

HOURS REQUIRED: 140

DESCRIPTION

This course will introduce the student to concepts of utilizing a random access storage device, and programming techniques required in using the device properly. He will reinforce and extend the programming principles and techniques he has learned by additional practice problems and demonstrations.

MAJOR DIVISIONS	HOURS
I. Introduction to 1620/1311 disk storage concepts	2
II. History of disk file development	2
III. Physical layout and addressing considerations of the 1311 disk file	5
IV. Timing considerations	6
V. File organization and utilization	15
VI. Programming - Instructions and practice	60
VII. Use of disk utility program	15
VIII. File inquiry	10
IX. Programming case study	25

DIVISION I - INTRODUCTION TO 1620/1311 DISK STORAGE CONCEPTS

A. Need for large file capacity
   1. Limits of internal storage
   2. Files which must remain on-line for inquiry
   3. Large reference tables
   4. Off-line file storage (except at processing time)
B. Card, tape or disk files
   1. File size
   2. Record size
   3. File preparation
   4. Processing times (input/output)
   5. Accessibility of data (random, sequential or combination)

DIVISION II - HISTORY OF DISK FILE - DEVELOPMENT

A. IBM 305 Ramac
   1. Single access arm
   2. 5 million characters
B. 650 Ramac
   1. 3 access arms
   2. 20 million characters (4 boxes)
C. 1405 disk file
   1. Single access arm (add'l arms, 1 with 1411, 2 with 1410)
   2. 10 million characters
D. 1301 disk file
   1. Reading head for each disk face (comb arrangement)
   2. Up to 56 million characters (each box)
      Total 280 million characters

E. 1311 Disk file
    1. Reading head for each disk face (comb arrangement)
    2. 2 million characters (each pack)
       Total 10 million on-line on 5 drives
       Unlimited using interchangeable packs if file requirements allow

DIVISION III - PHYSICAL LAYOUT OF 1311 DISK FILE - ADDRESSING CONSIDERATIONS

A. Mounting and demounting disk packs
B. Physical description of disk pack
    1. 6 physical disks, spin at 40 ms per revolution
    2. Top surface, bottom surface not used
    3. 10 useable disk surfaces
    4. Sector layout and addressing
    5. Cylinder concept
C. Read or write more than one sector
D. Interchangeability of disk packs

DIVISION IV - TIMING CONSIDERATIONS

A. Seek (locate a new cylinder)
B. Rotational delay (prior to read or write)
C. Read - write (character transfer)
D. Rotational delay (before write check)
E. Write check
F. Practice exercises

DIVISION V - FILE ORGANIZATION AND UTILIZATION

A. Random versus sequential file organization
B. Fixed and variable length records
C. Blocked and unblocked records
D. Random and sequential transaction processing
E. Addressing the file
    1. Sequential
        a. Direct or table lookup
        b. Additions and deletions to file
        c. Resequencing
    2. Random
        a. Direct addressing
        b. Randomizing techniques
        c. Chaining of overflows
    3. Advantages and disadvantages of each method
F. File protection
    1. Dumping file
    2. Programmed protection
    3. Restart procedures
    4. System controls and checks
G. File allocation
    1. Programming systems
    2. Programs
    3. Work storage
    4. Data files

DIVISION VI - PROGRAMMING - INSTRUCTIONS AND PRACTICE

A. Instruction format
B. Instruction set - absolute
    1. 34 (control)
    2. 36 read numeric
    3. 38 write numeric
C. SPS mnemonics
    1. RD, WD, CD
    2. RT, WT, CT
    3. SK
D. Disk control field
E. Check indicators
F. Other machine and file checks
G. Typical subroutines
    1. Read disk
    2. Write disk
H. Practice problems using disk storage
    1. Tables
    2. Intermediate storage
    3. Program storage and call
    4. Sequential files
    5. Random files

DIVISION VII - USE OF DISK UTILITY PROGRAM

A. Need for file handling programs
B. Writing addressed
C. Dumping and loading files
D. Relocating files
E. Modifying data within file
F. Executive program maps
G. Program loading and maintenance

DIVISION VIII - FILE INQUIRY

A. Need for access to data in files
B. Inquiry subroutines within operating programs
C. Modification and security of files

DIVISION IX - PROGRAMMING CASE STUDY

A. File generation and loading
B. Schedule of updating
C. Diagramming of program(s)
D. Documentation and run books
E. Writing and testing of program(s)
F. Provision for inquiry
G. Demonstration of system

BIBLIOGRAPHY

A26-5604 1620 Reference Summary

C26-5600 1620/1710 Symbolic Programming System
J26-5546 Program Writing and Testing
A26-5650 1311 Disk Storage Drive, Mod.3
C26-5739 1620 Monitor I System Reference Manual
J26-5674 1620/1710 SPS II - D
A26-5730 1443 Printer for 1620/1710
C26-5736 1620 SPS III for 1443 Printer

See Computer Programming I for additional references

COMPUTER PROGRAMMING IV

HOURS REQUIRED: 90

DESCRIPTION

This course will introduce other data processing systems to the student. The course will include a survey of other basic types of computers. Additional programming experience will be gained by programming tape applications on the 1620. The basic concepts of autocoder/IOCS programming systems will be presented.

MAJOR DIVISIONS	HOURS
I. Tape programming concepts	15
II. Case problem in tape programming	40
III. Autocoder/IOCS programming system	15
IV. Fixed word length decimal machines	6
V. Fixed word length binary systems	6
VI. Practice problem on system other than 1620	8

DIVISION I - TAPE PROGRAMMING CONCEPTS

A. Magnetic Tape Characteristics
   1. Coding
   2. Checking (parity)
   3. Function
   4. Speed

B. Magnetic tape file organization
   1. Logical record
   2. Tape record
   3. Grouped records
   4. Segmented records
   5. Tape reel
   6. Tape file

C. Instructions
   1. Tape read
   2. Tape write
   3. Branch on error
   4. Branch on end of reel
   5. Rewind tape
   6. Rewind and unload
   7. Backspace tape record
   8. Skip and blank tape
   9. Write tape mark

D. End of reel, file job routines

E. Timing individual tape operations

F. The medium-scale tape system in support of a large-scale data processing system
   1. Pre-edit
   2. Peripheral operations
      a. Card-to-tape
      b. Tape-to-card
      c. Tape-to-printer

DIVISION II - CASE PROBLEM IN TAPE PROGRAMMING

A. Definition of problem
    1. Two input files to be updated
    2. Transactions from cards
    3. Detail listings and summary reports
B. Documentation of procedures and program
C. Demonstration of running program

DIVISION III - AUTOCODER/IOCS PROGRAMMING SYSTEM

A. Introduction to autocoder system
    1. Definition
    2. Format of coding sheets and listing
    3. Macro-instructions
    4. Declarative statements
    5. Imperative statements
    6. Control statements
    7. Processor operation
B. Input/output control system
    1. Get, put, blocked records
    2. I/O error correction routines
    3. End-of-reel, end-of-file routines
    4. Systems control
    5. Tape labels
    6. Check point and restart
    7. Area definitions
    8. Standard file definition and control cards

DIVISION IV - FIXED WORD LENGTH DECIMAL SYSTEMS

A. Concept of fixed word length processors
    1. Word format
    2. Parallel processing and data movement
    3. Buffered input-output
    4. Accumulators and adders
    5. Block transmission
B. Instruction format
    1. Operation codes
    2. Data address(s)
    3. Control
    4. Indexing
C. Operations involving accumulators
    1. Addition
    2. Subtraction
    3. Sign control
    4. Shift control
    5. Overflows
D. Logic instructions
    1. Branching
    2. Alteration switches
    3. Interrupts and priority control
    4. Electronic switches
E. Table lookup

DIVISION V - FIXED WORD LENGTH BINARY SYSTEMS

A. Storage layout, machine size, word format
B. Instruction format
    1. Word layout
    2. Fixed point-floating point
    3. Basic arithmetic operations
    4. Instruction cycle
C. Data channel operation
    1. Commands and instruction
    2. Data channel registers
    3. Data channel trap
D. Data flow in the 709
E. Word transmission instructions
F. Control operations
G. Indexing
H. Input-output operations

DIVISION VI - PROGRAM A PRACTICE PROBLEM ON SYSTEM OTHER THAN 1620

Assign a simple practice problem. Not intended to be a detailed problem to be tested.

Bibliography, see Page 37.

COMPUTER PROGRAMMING V

HOURS REQUIRED: 120

DESCRIPTION

This course will survey some advanced programming systems such as Cobol, Fortran, Report Program Generators, Sorts/Merges, etc. The student will not gain proficiency in the use of all these systems, but will understand the advantages and disadvantages of their use and possibly gain some experience through field trips.

MAJOR DIVISIONS	HOURS
I. Cobol	30
II. Report Program Generators	20
III. Sorts/Merges	10
IV. Simulators	10
V. Utility Programs	10
VI. Practice Programming Problems	40

DIVISION I - COBOL

A. Need for business language
B. History of Cobol
C. The Cobol processor - brief description
    1. Data division
    2. Procedure division
    3 Environment division
    4 Identification division
D. Language structure
    1. Elective and required
    2. Character set
    3. Names
    4. Constants
    5. Verbs
    6. Operators
    7. Cobol words
    8. Expressions
    9. Statements
    10. Sentences
    11. Paragraphs
    12. Sections
E. Detail of procedure division
    1. Program sheet
    2. Writing expressions, statements, sentences
    3. Verbs
    4. Practice problems
F. Detail of data division
    1. Organization
    2. File section entries
    3. Record description entries
    4. Working storage section
    5. Constant section

6. Qualification
7. Subscripts
8. Occurs
9. Redefines
10. Constructing tables
11. Practice problems

G. Environment division
   1. Configuration
   2. I/O section

H. Identification division

I. Practice problems

DIVISION II - REPORT PROGRAM GENERATORS

A. Purpose
   1. Need for
   2. Advantages and disadvantages
   3. When to use

B. General types
   1. Load and go
   2. Generalized special purpose report generators
   3. All purpose report program generators

C. Writing of specifications
   1. Description and headings
   2. Report layouts
   3. Report specifications
   4. Data input specifications
   5. Processing specifications

D. Processing or generations of program

E. Practice problem in selected system

DIVISION III - SORTS/MERGES

A. The need for sorting and merging systems

B. Sorting and merging as an integral part of a manufacturer's support program

C. History and development of sort programs

D. The assignment portion

E. Phases of a sort program
   1. Phase I
      a. Sequence of strings
      b. Blocking factors
      c. "Order" of the merge
      d. Completion of the phase
   2. Phase II
      a. Merging the sequences or strings
      b. Types of merges
      c. Effects of varying numbers of tape drives
   3. Phase III
      a. Final merge pass
      b. Making modifications in Phase III
      c. Summarizing, deleting, alterations, etc. during Phase III

F. Internal sorting techniques
G. Timing considerations
H. Generalized vs specific sorts
I. A practical exercise

DIVISION IV - SIMULATORS

A. Introduction
    1. Purpose of simulation
    2. Simulation as a management tool
    3. Practical simulation applications
B. Local structure, system study
C. General simulation output information
D. Statistical variations
E. Priority level evaluation and peak load effects
F. Elements of a simulation program
G. Symbolic notations and purposes
H. Operating characteristics
I. Summary

DIVISION V - UTILITY PROGRAMS

A. Introduction to use of utility programs
    1. Purpose
    2. Examples and descriptions
B. Commonly used programs
    1. Clear storage
    2. Card deck loaders
    3. Tape-to-card, card-to-tape, tape-to-printer
    4. Disk-to-card, card-to-disk, disk-to-printer
    5. Core dumps
    6. Tape or disk dumps
    7. Debugging aids
C. Examples of specific programs and use
D. Practice problems and field trips

DIVISION VI - PRACTICE PROGRAMMING PROBLEMS

A. Assign practice problems on other systems
B. Assign field trip practice problems
    1. Sorts/merges
    2. Utility programs
    3. Report program generators
C. Assign Cobol problems to be run during field trips

BIBLIOGRAPHY

F28-8053 Cobol General Information
220-8045 Department of Defense 1961 Cobol Specifications
J24-1474 1401 Cobol Preliminary Specifications
C24-3063 1440 Report Program Generator Student Text

C24-3001 1440 Report Program Generator
R25-1668 1440 Report Program Generator Education Guide
R25-1669 1440 RPG Practice Problems
C24-1487 1401 Fargo
J28-0253 1410 Sort-Merge Reference Manual
F28-8001 Sorting Methods
J24-1436 1401 Sort 2/Merge 2 Preliminary Specifications
C24-3009 1440 Sort 5 Preliminary Speicifications
H20-4210 1620 Inventory Simulator
H20-6303 7090 General Purpose Simulator
J24-1435 1410 Utility Programs
J24-1411 Utility Programs for 1401 Tape Systems
J24-0209 Utility Programs for 1401 Card Systems

SYSTEMS DEVELOPMENT AND DESIGN I

HOURS REQUIRED: 40

DESCRIPTION

The effective use of data processing equipment and management sciences in meeting the information needs of business requires that much skill and knowledge be applied to the development and design of data processing systems. The course is designed to guide the student through the three stages in the evolution of a system, the analysis of present information flow, system specifications and equipment selections, and implementation of the system.

The scope of a system development study will vary from a modest payroll procedure to the total information system of a large and complex business.

MAJOR DIVISIONS

I. The approach
II. Requirements of the system
III. Developing the solution
IV. Data controls
V. System controls
VI. System evaluation
VII. Finalizing the system
VIII. System implementation

DIVISION I - THE APPROACH

A. Application research
B. Problem definition
C. Scope of the study
D. Objectives
E. Desired results
F. Target dates and study phase responsibility
G. Education of serviced departments
H. Management's role

DIVISION II - REQUIREMENTS OF THE SYSTEM

A. Fact gathering techniques
    1. Interview
    2. Tabular
B. Recording the facts
C. Reporting requirements
    1. Types of reports
    2. Report analysis
    3. Documentation
    4. Operating reports or documents

D. Source data requirements
    1. Report generating data
    2. Data documentation
    3. Format design and coding definitions
E. Analyzing the facts

DIVISION III - DEVELOPING THE SOLUTION

A. General systems flow charting
    1. Standards
    2. Symbols
    3. Forms and tools
B. Decision tables
    1. Common elements
    2. Limited vs extended entry
    3. Accuracy checks
C. Documentation
D. Presentation
E. Review

DIVISION IV - DATA CONTROLS

A. Objectives
B. Data Analysis
    1. Completeness
    2. Design suitability
    3. Mechanized transcription
C. Adjustments, corrections, and their control
D. Data control methods
E. Automatic and semi-automatic entry methods and equipment

DIVISION V - SYSTEMS CONTROL

A. The need
B. Standard techniques - machine oriented
C. Unique techniques - application oriented
D. Audit trails

DIVISION VI - SYSTEMS EVALUATION

A. Quality of results
B. Over-all time cycle
C. Inherent advantages
D. Cost factors
E. The evaluation team
F. Evaluation report
G. Management approval and support

DIVISION VII - FINALIZING THE SYSTEMS

A. Incorporating necessary changes
B. Procedure writing
    1. Nature and extent
    2. Importance of clarity and conciseness

C. Inter-departmental policy resolutions
    1. Coordination
    2. Approval
D. Training manuals
E. Detailed problem definitions
    1. Narrative
    2. Flow charts
    3. Record and report layouts
    4. Processing controls
    5. System controls
    6. Audit trails

DIVISION VIII · SYSTEM IMPLEMENTATION

A. Responsibility
    1. Staff
    2. Line
B. Planning and coordination
    1. Plan of action
    2. Sequence of events timetable
    3. Scheduling
    4. Follow-up
C. Training plans
D. Progress reporting
E. Assigning responsibility and follow-up
F. Actual cut-over or conversion
    1. Timing
    2. Breaking-in period
    3. Parallel operations
    4. Other conversion techniques

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Lazzard, Victor, Systems and Procedures, Englewood Cliffs, N. J.: Prentice-Hall, Inc. 1959.

Grabbe, Ramo, and Woldridge, Handbook of Automation, Computation and Control, New York: John Wiley and Sons, Inc. 1959.

Gregory and Van Horn, Automatic Data Processing Systems. San Francisco: Wadsworth Publishing Co., Inc. 1960.

McCracken, Weiss, and Lee, Programming Business Computers. New York: John Wiley and Sons, Inc. 1959.

J20-8014 Data Processing Bibliography
C20-8093 Coding Methods
F20-6088 Planning for an IBM Data Processing System
C20-8060 Document and Accounting Controls
C20-8078 Form and Card Design
C20-8089 Glossary for Information Processing
F20-8102 Decision Tables

SYSTEMS DEVELOPMENT AND DESIGN II

HOURS REQUIRED 60

CASE STUDY IN DOCUMENTATION

This unit of study reinforces the principles learned in Systems Development and Design I. The student should take a defined problem and develop the data processing data flow and procedures, design report forms and card layouts, develop test data, wire control panels, write computer programs, properly document all aspects of the system and demonstrate the complete operation to the instructor or the entire class. Two to three students could work as a team in development of this project.

The project should be assigned at the beginning of the quarter to allow maximum time for completion.

SYSTEMS DEVELOPMENT AND DESIGN III

HOURS REQUIRED 60

FIELD APPLICATION PROJECT

This unit of study will be similar to Systems Development and Design II. If possible, this project should be a field project in which the student responsibility would begin with definition of the project and continue through all aspects of development, culminating in complete documentation of the procedure and demonstration of the completed project to the instructor or the entire class.

This project should be assigned individually or to teams at the beginning of the quarter to allow maximum time for completion.

ACCOUNTING I

HOURS REQUIRED: 36 (3 quarter hours)

DESCRIPTION

The course introduces the student to the accounting field. Emphasis is placed on need for and uses of accounting with definitions of the principles, methods, and types of systems. Appreciation for the various types of reports, their accuracy, and their timeliness is developed. The need for understanding the accounting vocabulary is emphasized; through understanding comes effective communication.

This course provides the necessary background understanding of the mechanics of accounting--the collection; summarization; analyzing; and reporting, in monetary terms, information about the business. As the mechanics of accounting become well formulated, it is practical to introduce the concept of the use of data processing machines in performing the accounting functions within an organization. Case studies are used as a means to effectively impart these concepts.

MAJOR DIVISIONS

I. Description of accounting
II. Basic accounting procedures

DIVISION I - DESCRIPTION OF ACCOUNTING

A. The nature of accounting and its significance
B. The language of accounting
C. Principles and conventions of accounting
D. Detailed description of accounting
    1. Installation of systems
    2. Recording processes
    3. Preparation of reports
    4. Auditing
    5. Tax accounting
    6. Budgeting
    7. Cost accounting
    8. Controllership
    9. Special investigation
E. Machine versus manual accounting methods
    1. Account structure and transaction coding
    2. Relationship between accountant and data processing section
    3. Control and audit
    4. Scheduling and batch processing

DIVISION II - BASIC ACCOUNTING PROCEDURE

A. The fundamental equation

B. Bookkeeping tools
    1. The account (or chart of accounts)
    2. Debit and credit
    3. The journal
    4. The ledger
    5. Special journals and ledger
C. Mechanics of accounting (bookkeeping)
    1. Opening
    2. Analysis
    3. Journalizing
    4. Posting
    5. Adjustments
    6. Closing
    7. Reporting (summary)
D. Bookkeeping exercises
    1. Course in bookkeeping: to complete the bookkeeping cycle in its simplest form - to acquaint student with vocabulary, techniques and the disciplines
    2. Continue to include special journals and subsidiary ledgers

See Bibliography, Page 49.

ACCOUNTING II

HOURS REQUIRED: 36 (3 quarter hours)

DESCRIPTION

This course continues the training in basic accounting principles and concepts. Accounting services are shown as they relate to the management function. The concepts of performing accounting functions on data processing machines are emphasized throughout the course.

MAJOR DIVISIONS

I. Accounting procedures - continued
II. Developing, organizing and using accounting data
III. Types of accounting structures

DIVISION I - ACCOUNTING PROCEDURES - CONTINUED

A. Accounting for adjustments
    1. Depreciation, depletion and bad debts
    2. Accrued income and expense
    3. Prepaid expense and advance receipts
B. Partnership accounting
C. Controls and records
    1. Voucher system
    2. Inventory control and evaluation
    3. Business budgets
    4. Notes receivable and payable
    5. Taxes on sales, income and property
D. Routine accounting procedures survey - manual/machine
    1. Purchases and sales
    2. Cash receipts records
    3. Cash payments records
    4. Payroll records and transactions

DIVISION II - DEVELOPING, ORGANIZING AND USING ACCOUNTING DATA

A. Data medium and media
B. Structure and classification of accounts
C. Manual methods and devices
D. Mechanical methods and devices
E. Integration concepts
F. Organization structure for control
G. Management reports
H. Systems review
    1. Objectives
    2. Techniques
    3. Kinds of reviews

DIVISION III - TYPES OF ACCOUNTING STRUCTURES

A. Corporation accounting
    1. Organization
    2. Recording transactions
    3. Fiscal closing
B. Manufacturing accounting
    1. Variances from routine accounting
C. Accounting for various types of sales
    1. C. O. D.
    2. Installment and trade in
    3. Consignments
    4. Service department

See Bibliography, Page 49.

ACCOUNTING III

HOURS REQUIRED: 36 (3 quarter hours)

DESCRIPTION

This course emphasizes uses of accounting information. The emphasis is on accounting as a source of financial data for management control rather than on bookkeeping skills. Accounting services are shown as they contribute to the recognition and solution of a management problem. The concepts of performing accounting services on data processing machines are emphasized throughout the course.

MAJOR DIVISIONS

I. Presentation of financial data
II. Analysis and interpretation of financial data
III. Managerial control
IV. Managerial planning

DIVISION I - PRESENTATION OF FINANCIAL DATA

A. The balance sheet
    1. Financial reporting
    2. Content of report
B. The income statement
    1. Progress measurement tool
    2. Content of report

DIVISION II - ANALYSIS AND INTERPRETATION OF FINANCIAL DATA

A. Asset and equity structure
    1. Industry variations
    2. Liquidity
    3. Tax factors
B. Changing dollar valuation
C. Evaluation regarding earning power, asset turnover, rate of return, trends, etc.
    1. Relationships within income statement
    2. Ratios and percentages
    3. Acid test ratio
    4. Appraisal of findings
D. Flow of funds
    1. Significance of analysis
    2. Projection analysis
E. Flow of cash
    1. Significance of analysis
    2. Comparison of funds and cash flow
    3. Effect of changes

DIVISION III - MANAGERIAL CONTROL

A. Internal controls and reports
    1. Adequacy
    2. Protection
B. Cost concepts
    1. Elements
    2. Planning
    3. Procedure
    4. Allocation
C. Cost controls and systems
    1. Types of systems
        a. Job order
        b. Process cost
        c. Standard
        d. Variable costing

DIVISION IV - MANAGERIAL PLANNING

A. Cost, volume, profit relationships
B. Budgets
    1. Sales
    2. Production
C. Coordinated budget
D. Decision making through cost analysis
E. Planning capital expenditures
F. Pricing decisions
G. Use of quantitative techniques
    1. Importance of technique
    2. Types of solutions - linear prog, graphic, algebraic, simplex

Bibliography:

20th Century Bookkeeping & Accounting, 22nd Edition, Carlson, Forkner, Boynton, South-Western Publishing Co.
20th Century Bookkeeping & Accounting, 22nd Edition (Advanced Course) Carlson, Forkner, Boynton, South-Western Publishing Co.
Accounting Systems and Data Processing, Nelson, Woods, South-Western Publishing Company
Managerial Accounting, Moor, Jaedicke, South-Western Publishing Co.
Accounting, Meigs & Johnson, McGraw-Hill Book Co.
Fundamental Accounting, 3rd Edition, Tunick & Sare, Prentice-Hall

PRINCIPLES OF STATISTICAL ANALYSIS I

HOURS REQUIRED: 36

DESCRIPTION

The purpose of this course is to (1) provide a practical foundation upon which data processing problem solving can be based and (2) discipline the students in the art of logical decision making, using mathematics as the vehicle. This course treats primarily the numerical, rather than the theoretical, solution to problems.

The principles presented will be applied (and therefore reinforced) in the Computer Programming and in the Statistics courses.

One year of high school algebra is required for admission.

MAJOR DIVISIONS

I. Introduction to probability and statistics
II. Permutations, combinations and the binomial theorem
III. Probability theory for finite sample spaces
IV. Random variables, distributions

DIVISION I - INTRODUCTION TO PROBABILITY AND STATISTICS

A. Applications of statistical analysis
    1. Examples
    2. How are models developed
    3. The growth of statistical analysis
B. The field of statistics
    1. What is statistical analysis
    2. Misuses of statistics
    3. Effective uses of statistics
C. Probability and statistics
    1. Interpretations of probability
    2. Illustrations and applications
    3. Illustrations of variability
    4. Changing probability

DIVISION II - PERMUTATIONS, COMBINATIONS AND THE BINOMIAL THEOREM

A. The principle of multiplication
B. What is permutation? A combination
C. Applications of permutation and combination formulas
D. Exercises and problems
E. Review of the binomial theorem
F. Probability - equally likely outcomes
    1. Experiments
    2. Sample spaces
    3. Events and sets
    4. Mutually exclusive and independent sets

5. Conditional probability
6. "Randomness"

DIVISION III - PROBABILITY THEORY FOR FINITE SAMPLE SPACES

A. Finite Sample spaces
   1. What are finite sample spaces
   2. Examples and formulas
   3. Complementary events
B. Independent events
   1. Definition
   2. Consideration of independents
   3. Exercises and problems
C. Conditional probability

DIVISION IV - RANDOM VARIABLES, DISTRIBUTIONS

A. Random variables
   1. Random variables and their probability functions
   2. Mathematical expectation of a random variable
   3. Mean, average and variance of a function
B. Distributions
   1. Probability distribution
   2. Frequency distribution
C. Exercises and problems

BIBLIOGRAPHY:

Mode, E. B., Elements of Statistics: Englewood Cliffs, New Jersey: Prentice-Hall, 1951

Croxton, F. E., and Cowden, D. J., Applied General Statistics. Englewood Cliffs, New Jersey: Prentice-Hall, 1955

Mosteller, Rourke, and Thomas, Probability and Statistics. Reading, Mass.: Addison-Wesley Publishing Co., 1961

Wallis, W. A., and Roberts, H. V., Statistics: A New Approach. Glencoe, Ill.: The Free Press, 1956

PRINCIPLES OF STATISTICAL ANALYSIS II

HOURS REQUIRED: 36

DESCRIPTION

This course is a continuation of Principles of Statistical Analysis I. It will include some practice applications to provide practice in using the principles learned.

MAJOR DIVISIONS

I. The normal distribution
II. The theory of sampling
III. Binomial probability distribution and central limit theorem
IV. Applications

DIVISION I - THE NORMAL DISTRIBUTION

A. Joint and continuous distributions
    1. Joint probability function of two random variables
    2. Probability graphs for continuous random variables
    3. Probabilities represented by areas
B. The normal curve

DIVISION II - THE THEORY OF SAMPLING

A. Calculation of the distribution of a sum
B. The variance of the distribution of a sum of two variables
C. Variance of the sum, and the average of several variables
D. Exercises and problems

DIVISION III - BINOMIAL, PROBABILITY DISTRIBUTIONS AND CENTRAL LIMIT THEOREM

A. Binomial experiments
B. "N" trials of the binomial experiment
C. Expected value of a binomial random variable
D. Binomial probability tables
E. Binomial distribution properties
F. The central limit theorem for the binomial
G. Summary of the binomial theorem

DIVISION IV - APPLICATIONS

A. Assignment of selected statistical problems
B. Use of data in making projections
C. Testing reliability of data and projections

BIBLIOGRAPHY

References are the same as listed under Principles of Statistical Analysis I.

Beach and Clark, Psychology in Business. McGraw-Hill Book Co.,Inc.

Ruch, Psychology & Life, 6th Ed., Scott-Foresman & Co.

Hegarty, How to Build Job Enthusiasm, McGraw-Hill Book Co.,Inc.

D. Accounting
E. Top management
F. Reports required

DIVISION V - FINANCING THE BUSINESS

A. Stocks
B. Bonds
C. Reinvested earnings

BIBLIOGRAPHY

Amrine, Harold T. and others, Manufacturing Organization and Management. New York, New York. Prentice-Hall, Inc., 1957.

Bethel, Atwater, Smith and Stackman, Industrial Organization and Management. New York, New York. McGraw-Hill Book Co., Inc., 1956.

Durand, Robert, Business: Its Organization, Management and Responsibilities. New York, New York. Prentice-Hall, Inc., 1958.

Kelley, Pearce C., and Lawyer, Kenneth, How To Organize and Operate a Small Business. New York, New York: Prentice-Hall, Inc., 1955.

Shilt, Bernard A. and Wilson, W. Harmon, Business Principles and Management. New Rochelle, New York: South-Western Publishing Co., Fourth Edition.

Tonne, Simon and McGill, Business Principles, Organization, and Management. New York, New York: Gregg Publishing Division, McGraw-Hill Book Co., Inc., 1958.

DATA PROCESSING MATHEMATICS I (FALL QUARTER)

HOURS REQUIRED: 36

DESCRIPTION

The purpose of this course is to (1) provide a practical foundation upon which data processing problem solving can be based and (2) discipline the students in the art of logical decision making, using mathematics as the vehicle. This course treats primarily the numerical, rather than the theoretical, solution to problems.

The principles presented will be applied (and therefore reinforced) in the Computer Programming and in the Statistics courses.

MAJOR DIVISIONS

I. The number systems
II. Representation of a number with an arbitrary base
III. Basic algebra

DIVISION I - THE NUMBER SYSTEMS

A. Base 10 numbering system
B. Rational and irrational numbers
C. Powers and roots

DIVISION II - REPRESENTATION OF A NUMBER WITH AN ARBITRARY BASE

A. Binary
B. Octal
C. Conversion from one base to another

DIVISION III - BASIC ALGEBRA

A. Algebraic expressions
B. Algebraic fractions
C. Factoring
D. Polynomials
E. Subscripts
F. Use of exponents

DATA PROCESSING MATHEMATICS II (WINTER QUARTER)

HOURS REQUIRED: 36

MAJOR DIVISIONS

I. Logarithms
II. The concepts of notation
III. Linear equations
IV. Precision and significance
V. Fixed and floating point numbers

DIVISION I - LOGARITHMS

A. Base 10 logarithms
B. Applications of logarithms
C. Slide rule (introduction)

DIVISION II - THE CONCEPTS OF NOTATION

A. Functional notations
B. Infinite sum
C. Arithmetic Progression and series

DIVISION III - LINEAR EQUATIONS

A. Equations with one unknown
B. Equations with two and greater unknowns
C. Determinants

DIVISION IV - PRECISION AND SIGNIFICANCE

A. Precision
B. Significance
C. Absolute and relative error

DIVISION V - FIXED AND FLOATING POINT NUMBERS

A. Fixed point
    1. Scaling
    2. Advantages
B. Floating point
    1. Mantissa
    2. Exponent
    3. Advantages

DATA PROCESSING MATHEMATICS III

HOURS REQUIRED: 36

DESCRIPTION

The Data Processing Mathematics III is a continuation of Data Processing Mathematics II. Numbers systems, forms, and methods basic to data processing are continued and extended.

MAJOR DIVISIONS

I. Concept of an iterative process
II. Solution of simultaneous linear equations
III. Logic
IV. Boolean algebra
V. Methods of numerical computation
VI. Classification of errors in the numerical solutions of a problem

DIVISION I - CONCEPT OF AN ITERATIVE PROCESS

A. Algorithm
B. Applications of iterative process
C. Advantages

DIVISION II - SOLUTION OF SIMULTANEOUS LINEAR EQUATIONS

A. Definition and notation
B. Elimination scheme
C. Gauss-Seidel method

DIVISION III - LOGIC

A. Introduction to logic
B. Deductive logic
C. Inductive logic
D. Logical basis
E. Logical basis for mathematics

DIVISION IV - BOOLEAN ALGEBRA

A. Connectives
B. Truth tables
C. Machine implementation of arithmetic operations

DIVISION V - METHODS OF NUMERICAL COMPUTATION

A. Applications of numerical solutions to physical problems

DIVISION VI - CLASSIFICATION OF ERRORS IN THE NUMERICAL SOLUTIONS OF A PROBLEM

A. Error in mathematical approximation
B. Error in the measurement of parameters
C. Truncation errors
D. Round-off errors
E. Ill conditioned equations

BIBLIOGRAPHY

Richardson, M., Fundamentals of Mathematics: Macmillan Co.

Hohn, F. Applied Boolean Algebra: Macmillan Co.

Wade and Taylor, Fundamental Mathematics: McGraw-Hill.

COMMUNICATION SKILLS I, II, AND III

This course in Communication Skills is especially designed for the vocational-technical student. It differs considerably from the usual college freshman course in composition as it deals with the total problem of communication among people, emphasizing reading, writing, listening and speaking, and leads toward the third and final quarter of technical report writing.

It is recognized that communication is an essential part of all phases of business and industry as the worth of a person's ideas and knowledge are dependent on his ability to communicate effectively. Effective communication abilities are of prime importance for those who advance to responsible positions. In this course, the student's strengths and weaknesses are analyzed through the use of diagnostic tests and exercises in writing, speaking, reading, and listening. Both technical and social skills are emphasized throughout the entire course.

The first course, in a three-quarter sequence, begins with the purpose of communication -- dynamics, functions, and methods of communication. This approach, which prepares the student psychologically, is designed to overcome some of the barriers to mastering English. The latter part of the quarter concerns reading improvement and oral communications (speech and conference leading are included in the first quarter). This enables a student to enter the first or second quarter without missing the essentials of basic English, which are taught in the second quarter as a background for the third quarter, technical report writing.

Because of the varied academic backgrounds brought into a vocational-technical training situation, individual instruction is emphasized as well as those aspects of communication necessary for a technician to communicate with both the craftsman and the professional person.

COMMUNICATION SKILLS I

HOURS REQUIRED: 36

DESCRIPTION

The nature and dynamics of communication are presented in the first half of this quarter. The fundamental concepts treated here have important implications for organizations of all types--business, industrial, government, military, social, public, and civic. The principal concern of this course is with the practical uses of the communication process within the business organization and, in particular, within the data processing department.

The second half of this quarter emphasizes practice in conference leading with the students performing as conference leaders, conference reporters, as well as participating in the different types of conferences. Listening skills emphasized: "Hear it right the first time." Stress is put upon hearing exactly what the speaker said and recording the principal points in note form. Understanding and following instructions form an important part of listening skills. Speech is concerned primaril with the illustration-demonstration type. Students practice organizing and giving presentations concerned with explaining and demonstrating to the class the use and operation of equipment. The relation of this type of training to the industrial situation is readily apparent.

MAJOR DIVISIONS

I. The dynamics of communication
II. The qualities of communication
III. The functions of communication
IV. The methods of communication
V. Talking and listening
VI. Conference leading
VII. Improving reading efficiency

DIVISION I - THE DYNAMICS OF COMMUNICATION

A. The nature of people
   1. Beliefs and motivation
   2. Alone
   3. Interaction
   4. In groups
   5. In organizations

B. The nature of communication
   1. What it is
   2. The events, elements, sequence of communication
   3. Communication control
   4. Occasions of communication

DIVISION II - THE QUALITIES OF COMMUNICATION

A. Communicating effectively
B. Communicating efficiently
C. Communicating clearly

DIVISION III - THE FUNCTIONS OF COMMUNICATION

A. Information
    1. Scope of information communication
    2. Uses of information
    3. Exchange of information

B. Evaluation
    1. The basis of evaluation
    2. The content of evaluation
    3. The manner of evaluation

C. Instructive
    1. Instructions and procedures
    2. Training
    3. Direction, implementation, and communication

D. Influence and persuasion
    1. The nature of influence
    2. Leadership and influence
    3. Influence, decision and expectation
    4. Process and techniques of persuasion
    5. Ethics of persuasion and influence
    6. Communication and influence
E. Other functions of communication

DIVISION IV - THE METHODS OF COMMUNICATION

A. Tools and techniques
    1. Thinking and communication
    2. Observing, reading and listening
    3. Skill in receiving
    4. Communication tools
    5. Functional English
    6. Interest and attention

B. Preparation, presentation and adaption
C. Forms and media of communication

DIVISION V - TALKING AND LISTENING

A. Diagnostic testing
B. Organization of topics or subject
C. Directness in speaking
D. Gesticulation and use of objects to illustrate
E. Conversation courtesies
F. Listening faults
G. Taking notes
H. Understanding words through context clues
I. Exercises in talking and listening

DIVISION VI- CONFERENCE LEADING

A. General use of conferences
B. Description of the role and responsibilities of the conference leader, conference reporter and the conferences
C. Different types of conferences
    1. General problem solving
    2. Five-step method of problem solving
    3. Informational conference
    4. Sell and tell conference (using chart board)
    5. Brainstorming conference

DIVISION VII - IMPROVING READING EFFICIENCY

A. Diagnostic tests
B. Reading habits
    1. Correct reading posture
    2. Light sources and intensity
    3. Developing proper eye span amd movement
    4. Scanning
    5. Topic sentence reading
C. Footnotes, index, bibliography, cross reference, etc.
D. Techniques of summary
    1. Outline
    2. Digest of brief
    3. Critique
E. Exercises in reading improvement
    1. Reading for speed
    2. Reading for comprehension

See Bibliography, Page 66

COMMUNICATION SKILLS II

HOURS REQUIRED: 36

DESCRIPTION

Communication Skills II is a survey of general English for the basic purpose of providing a background for the third quarter which develops report writing. The first half of this quarter deals with basic grammar, sentence structure, vocabulary and word meaning. The second half includes methods of paragraph development and the statements of ideas written for specific purposes. It is not concerned with using short staccato-like sentences for action, or with the use of long flowing passages in description, nor with the use of suggestion to create a mood for literary purposes. Rather, it is concerned with the writing of short, lucid, grammatically correct sentences and logically organized paragraphs.

MAJOR DIVISIONS

I. Sentence structure
II. Using resource material
III. Written expression

DIVISION I - SENTENCE STRUCTURE

A. Diagnostic test
B. Review of basic parts of speech
C. What makes complete sentences
D. Use and placement of modifiers, phrases, and clauses
E. Sentence conciseness
F. Exercises in sentence structure

DIVISION II - USING RESOURCE MATERIAL

A. Orientation in use of school library
    1. Location of reference materials, Readers Guide, etc.
    2. Mechanics for effective use
    3. Dewey Decimal System

B. Dictionaries
    1. Types of dictionaries
    2. How to use dictionaries
    3. Diacritical markings and accent marks

C. Other reference sources
    1. Technical manuals and pamphlets
    2. Bibliographies
    3. Periodicals
D. Exercises in the use of resource materials
    1. Readers Guide
    2. Atlases
    3. Encyclopedias
    4. Other
E. Diagnostic test

DIVISION III - WRITTEN EXPRESSION

A. Diagnostic test
B. Paragraphs
    1. Development
    2. Topic sentence
    3. Unity and coherence
C. Types of expression
    1. Inductive and deductive reasoning
    2. Figures of speech
    3. Analogies
    4. Syllogisms
    5. Cause and effect
    6. Other
D. Written exercises in paragraphs
E. Descriptive reporting
    1. Organization and planning
    2. Emphasis on sequence, continuity, and delineation to pertinent data or information
F. Letter writing
    1. Business letters
    2. Personal letters
G. Mechanics
    1. Capitalization
    2. Punctuation
    3. Spelling
        a. Word division--syllabication
        b. Prefixes and suffixes
        c. Word analysis and meaning--context clues, content analysis phonetics, etc.
H. Exercises in mechanics of written speech

See Bibliography, Page 66.

COMMUNICATION SKILLS III

HOURS REQUIRED: CLASS 3: LABORATORY, 36 CLOCK HOURS

DESCRIPTION

Written material in the data processing field most effectively communicates when it is complete, accurate, and presented in the correct format. Technical report writing requires that the student analyze the purpose of the report and consider for whom it is written. He gathers his material through library research, organizes, evaluates it, and writes his report. He has practice in writing of abstracts and summaries. Each report receives two grades: one for quality of the technical content, and the other for quality of writing.

MAJOR DIVISIONS

I. Using resource material
II. Report writing
III. Graphic communication

DIVISION I - USING RESOURCE MATERIAL

A. Orientation in use of school library
    1. Location of reference materials, Readers Guide, etc.
    2. Mechanics for effective use
    3. Dewey Decimal System
B. Other reference sources
    1. Technical manuals and pamphlets
    2. Bibliographies
    3. Periodicals
C. Exercises in the use of resource materials
    1. Readers Guide
    2. Atlases
    3. Encyclopedias
    4. Other
D. Diagnostic test

DIVISION II - REPORT WRITING

A. Choosing subjects for reports
B. Outlining the report
C. Types of reports
D. Collecting information
E. Assembling material for report
F. Graphs showing relationships, charts.
G. Rewrite report
H. Make table of contents
I. Make title sheet
J. Write letter of transmittal and abstract
K. Make a bibliography

DIVISION III - GRAPHIC COMMUNICATION

A. Bar charts and histograms
B. Linear graphs
C. Effective pictorial presentations

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SOCIAL SCIENCE I - INDUSTRIAL PSYCHOLOGY

HOURS REQUIRED: 36

DESCRIPTION

At one time all industry required was that a man be able to do his work in a narrow area of specialization. Today industry is asking for men who, upon entry, have more than a beginning level of performance in their specialty; who also have the ability to get along with people on the team, and who have an inner drive which enables them to move ahead and not become "dead wood" on the promotional ladders. Industry also wants men who can and will represent the company to the community in a commendable manner, and know how to work with groups of people outside as well as inside the company.

Industrial Psychology is applied psychology of adjustment related to industrial groups and conditions. Designed to help the worker gain a better understanding of himself and others; psychological factors in society, family and industry; basic needs and adjustment relationships are all studied.

MAJOR DIVISIONS

I. Behavior
II. Adjustment concept
III. Physiological psychology
IV. Child development
V. Personality development
VI. Teaching, counseling and interviewing
VII. Human engineering
VIII. Accident prevention
IX. Motivation
X. Attitudes and job satisfaction
XI. Morale and monotony
XII. Psychological aspects of labor relations
XIII. Psychology of learning
XIV. Leadership

DIVISION I - BEHAVIOR

A. Types of behavior
B. Behavior and its causes
C. Introduction is self-concept

DIVISION II - ADJUSTMENT CONCEPT

A. Barriers
B. Direct attack
C. Substitute activity
    1. Positive
    2. Negative

DIVISION III - PHYSIOLOGICAL PSYCHOLOGY

A. Relation between organs of the body and mind
B. Psychosomatics

DIVISION IV - CHILD DEVELOPMENT

A. Different stages of life
B. One to five years of age
C. Parent's control
D. Childhood effect on adult adjustment

DIVISION V - PERSONALITY DEVELOPMENT

A. Main driving power in man
B. Unconscious, ego, id, sub-conscious, super ego
C. Successful life-build self image
D. Philosophy of life

DIVISION VI - TESTING, COUNSELING, INTERVIEWING

A. Types of tests and their uses
B. Give students test battery
C. Counseling
D. Types of interviews and their purposes

DIVISION VII - HUMAN ENGINEERING

A. Study of people at work
B. Job methods
C. Time and motion study
D. Nature of fatigue (environmental)

DIVISION VIII - ACCIDENT PREVENTION

A. Accident proneness
B. Causes of accidents
C. Industrial safety programs

DIVISION IX - MOTIVATION

A. Fundamentals of motivation
B. Frustrations
C. Incentives
D. Competitions
E. Worker participation in work goals

DIVISION X - ATTITUDES AND JOB SATISFACTION

A. Employee attitudes
B. Security
C. Opportunity
D. Increasing job satisfaction

DIVISION XI - MORALE AND MONOTONY

A. Morale factors
B. Improving morale
C. Monotony curve

DIVISION XII - PSYCHOLOGICAL ASPECTS OF LABOR RELATIONS

A. Group dynamics within labor
B. Union-management relations
C. Types of unions and their history

DIVISION XIII - PSYCHOLOGY OF LEARNING

A. Kinds of learning
B. Learning process
C. Suggestions for better learning
D. How to study effectively

DIVISION XIV - LEADERSHIP

A. What makes a leader
B. Qualities of leadership
C. Influencing the behavior of others

See Bibliography, Page 74.

SOCIAL SCIENCE II - SUPERVISORY TRAINING
Getting Work Done Through People

HOURS REQUIRED: 36

DESCRIPTION

Human relations as they relate to the supervisor and his job of getting work done through people; developing an understanding of people's behavior in work groups; behavior problems; motivation; discipline; and developing a better understanding of supervisory and management problems in modern industry are all included in this course.

MAJOR DIVISIONS

I. The job of supervision
II. Problem solving and case studies
III. Changing behavior
IV. Motivation
V. Handling employees dissatisfaction
VI. How to get co-operation
VII. Disciplinary problems
VIII. Working with people

DIVISION I - THE JOB OF SUPERVISION

A. What does management expect of the supervisor
B. Qualities, duties and responsibilities of a democratic supervisor
C. Types of supervision
D. Types of workers and their behavior

DIVISION II - PROBLEM SOLVING AND CASE STUDIES

A. Five steps in human relations problem solving
B. Problem solving conference
C. Case Studies

DIVISION III - CHANGING BEHAVIOR

A. Different types of behavior
B. Overcoming resistance to change

DIVISION IV - MOTIVATION

A. Basic needs
B. Barriers and frustrations
C. Morale and high productivity

DIVISION V - HANDLING EMPLOYEES DISSATISFACTION

A. Grievances
B. Relations between supervisor and crew
C. Steps and procedures for handling on-the-job conflicts

DIVISION VI - HOW TO GET CO-OPERATION

A. What is co-operation
B. How to develop co-operation
C. Supervisor's attitude

DIVISION VII - DISCIPLINARY PROBLEMS

A. Types of discipline
B. How to correct people
C. Preventative discipline

DIVISION VIII - WORKING WITH PEOPLE

A. How does a democratic leader work with his crew
B. Personal improvement
C. Review total course and summary

See Bibliography, Page 74.

SOCIAL SCIENCE III - INDUSTRIAL ECONOMICS

HOURS REQUIRED: 36

DESCRIPTION

Industrial Economics should develop a student's appreciation of the political and economic forces responsible for the growth and development of industry and technology; economics of production, land, labor and capital; laws of supply and demand; prosperity and depression cycles; labor's effects upon economics, including the historical development of organized labor.

MAJOR DIVISIONS

I. Political and economic forces
II. Economic expressions
III. Comparative economic systems
IV. Labor problems and legislation
V. Business law and management

DIVISION I - SOCIAL, POLITICAL AND ECONOMIC FORCES RESPONSIBLE FOR THE GROWTH AND DEVELOPMENT OF INDUSTRY AND TECHNOLOGY

A. Pastoral stage
B. Handicraft stage
C. Machine stage
D. Atomic stage
E. Planned economy or laissez faire

DIVISION II - ECONOMIC EXPRESSIONS

A. Land, resources (human and natural), capital, management and labor
B. Economic goods
C. Economic wealth
D. Utility
E. Other

DIVISION III - COMPARATIVE ECONOMIC SYSTEMS

A. Capitalism-free enterprise
B. Socialism
C. Communism
D. Other

DIVISION IV - LABOR PROBLEMS AND LEGISLATIO

A. Union policies and practices
    1. Wages, hours
    2. Closed shop
    3. Union shop
    4. Seniority
    5. Worker relationships
    6. Worker benefits - sickness, accident, other

B. Industrial strife
    1. Strikes
    2. Boycott, lockout, slow down, sabotage, picketing
    3. Mediation
C. Labor legislation
    1. Taft-Harcley law
    2. Labor-Management Reporting and Disclosure Act of 1959
    3. NLRB
    4. Wage-hour board
    5. Safety legislation
    6. Minimum wage law
    7. Fair Employment Practices Acts

DIVISION V - BUSINESS LAW AND MANAGEMENT

A. Types of organizations and legal aspects
    1. Single ownership
    2. Partnership
    3. Corporation
    4. Trusts and holding companies
    5. Security and commodity exchanges
    6. Public utilities
    7. Marketing co-ops
    8. Chattels and real estate
    9. Savings and loan associations
B. Our capitalistic system - private enterprises
    1. Trust laws
    2. Monopolies, franchises, fair trade
    3. Banks and banking
        a. Bank insurance
        b. Discounting and loans
    4. National income - sources
    5. Gross national product
    6. Personal income
    7. Public debt - limits
    8. Private debt - limits
    9. Government grading and quality controls
C. Finance, investment and taxation
    1. Investments and securities
    2. Stocks and bonds
    3. Monetary system
        a. Legal tender - coins, notes
        b. Federal Reserve System
        c. Fiat money
    4. Credit buying - effects of interest rate
    5. Taxation
        a. Income taxes
        b. Personal and real property taxes - assessment, evaluation, equalization, etc
        c. Corporation taxes
        d. Capitation taxes
        e. Inheritance taxes
        f. Theories of shifting and incidence in taxation
        g. Sales tax
        h. Other
    6. Insurance

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